OPERATING AND SERVICING MANUAL

TP-30 POWER SUPPLY

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Pasadena, California

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GENERAL DESCRIPTION

The Invar TP Series Power Supply is a precision, transistorized power supply which operates from 115V AC, 60 cps line voltage and delivers a precisely regulated DC output. It can be used in the laboratory or incorporated in other electronic equipment as a source of regulated power.

INSTRUCTIONS

1. Inspection

Unpack the supply carefully and inspect it for any damage which may have occurred in transit. If there is any damage, or if the instrument fails to operate properly when tested according to the instructions of Section 3, a claim should be filed with the carrier. Obtain a full report of the damage from the claim agent and send a copy of this report to us. Include the model number and serial number of the supply. Upon receipt of this we will advise you of the arrangements to be made for its repair or replacement.

2. Controls

A. Power Input: A three connector plug is used for the input line power connection. This third prong provides for grounding of the chassis of the power supply and should always be used for safety reasons. The input line connector is at the rear of the supply.

B. On-Off Switch: This switch controls the input of line power to the power supply. The pilot light should be lit when the supply is connected to the line and the switch is on. The supply is designed to operate from a 115 Volt, plus or minus 10%, 60 cps source.

C. Maximum Output Current Adjust: This control consists of the knob located below the "maximum output current adjust" on the front panel. This control can be used to set the maximum current the supply will deliver under any conditions of load. The range of the setting is from 14 to 35 Amperes. To operate this control, the supply should first be turned on. Adjust the potentiometer knob to desired maximum current. Now the supply of this setting is plus or minus 10%.

D. Output Terminals: DC output terminals are located on the front panel and at the rear of the supply. The output is floating and either the positive or negative terminal can be grounded.

E. Remote Sensing: The connections for the remote sensing leads are located at the rear of the chassis near the rear output terminals. To use remote sensing, remove the jumpers which connect the remote sensing leads with the output terminals and connect the remote sensing terminals to the load. BE SURE THAT THE JUMPERS ARE ALWAYS FIRMLY ATTACHED TO THE OUTPUT WHEN LOCAL SENSING IS USED. WHEN REMOTE SENSING IS USED, BE SURE THAT THE JUMPERS ARE REMOVED AND THE REMOTE SENSING LEADS CONNECTED TO THE LOAD.

F. Output Voltage Adjust: Both fine and coarse output voltage adjust potentiometers are located on the front panel. The nominal range of adjustment of the fine voltage control is 10% of the coarse voltage setting.

G. Pilot Light: The amber pilot light on the front panel should be lit when line voltage is applied and the power supply on-off switch on front panel is turned on.

H. Fuses: Fuses are provided on both the AC and DC sides of the supply. These fuses are located on the rear of the chassis.

3. Operation

A. Plug in line cord to a source of 115 VAC, 60 cps.

B. Turn the power supply on by means of the front panel on-off switch.

C. Adjust for proper output voltage.

D. Set the maximum output current by means of the ""maximum output current adjust"" controls. (See above description on controls.)

4. Circuit Description, TP-30

The input AC power is transformed and rectified in the circuit consisting of a variable autotransformer T1, transformer T2 and rectifiers CR1 to CR4. Capacitors C1-1 and C1-2 provide filtering for the raw DC power. This power is passed through the series regulating transistors Q10-1 through Q10-20 whose bases are driven, through drivers Q8 and Q9-1 and Q9-2, by the balanced amplifier of Q6 and Q7. The power supply output voltage is sensed at the base of Q7 and compared with a very stable reference voltage developed across R26, the output voltage fine control, and R27, the output voltage coarse control. The circuit of transistors Q2, Q3, Q4, Q5 and Zener reference diode CR12 is essentailly a small regulated DC supply whose purpose is to furnish a highly regulated comparison voltage to the base of Q6. Semi-regulated DC power to this small supply is furnished by T3, rectifiers CR5 to CR8, and Zener diodes CR9 and CR10. The circuit of Q1 and potentiometer R16 is the maximum output current adjust and short circuit protection circuit.

5. Maintenance and Trouble Shooting

A. The supply does not require any periodic maintenance other than cleaning to remove excessive dust and dirt. On models which use forced air cooling, the cage of the blower should be kept clean and the blower motor oiled occasionally. If it is necessary to replace components, use only first quality commercial components of values and types indicated on the parts list. No selected components are used. When replacing components or trouble shooting, observe caution since dangerous voltages may exist in the power supply. If it is ever necessary to replace the variable autotransformer or either of the two pots connected to the variable autotransformer by means of the gear chain, the following check should be used to insure that the gearing is correct. With the coarse output voltage control turned completely counter clockwise, the variable autotransformer T2 and the pots R7 (300 ohm) and R27 (1000 ohm) should be completely clockwise. When the coarse voltage control is completely clockwise the two pots should be completely clockwise and the variable autotransformer should be within five degrees of complete clockwise position.

B. Trouble Shooting Procedure:

1. Symptom: No output voltage.

   Cause: Fuse blown.

   Repair Procedure: Check for damaged rectifiers or shorted input capacitors or transformer before replacing AC fuse. If DC fuse is blown, check for possibility of overheating and short circuit. Remove short circuit.

2. Symptom: Poor load regulation.

   Cause: Maximum output current adjust potentiometer set at too low a value.

   Repair Procedure: Set pot to proper maximum current setting. This is about 20% higher than desired maximum current.

3. Symptom: Poor regulation and output cannot be reduced to zero by output voltage control.

   Cause: One of the series regulating transistors, Q10-1 through Q10-20, on the heat sink, or Q9-1 and Q9-2 on the board next to the heat sink, or Q8 on the main component board, is shorted.

   Repair Procedure: Replace transistor. To determine which transistor is shorted, open the emitter of Q8. If the output voltage drops to zero (without load) transistor Q8 should be replaced. If it does not drop, one of the series regulators, Q10-1 through Q10-20, is shorted and should be replaced.

4. Symptom: Power transformer and variable autotransformer overheated.

   Cause: One or more of the recitifers CR1 to CR4 are defective.

   Repair Procedure: Replace rectifier.

5. Symptom: Output voltage floats erratically.

   Cause: Remote sensing jumpers not tightly connected or, if remote sensing is being used, remote sensing leads not properly connected.

   Repair Procedure: Check sensing connections.

C. Typical Voltages at 115 VAC input:

VOLTAGE ACROSS COMPONENT

COMPONENT	OUTPUT VOLTAGE AT ZERO	OUTPUT VOLTAGE AT 30 VOLTS NO OUTPUT CURRENT	OUTPUT VOLTAGE AT 30 VOLTS 30 AMPS OUTPUT CUR.
C1	13	60	45
CR9	53	56 ±10%	56 ±10%
CR10	56	56 ±10%	56 ±10%
R24	44	44	44
R27	36	36	36

All measurements should be taken with a 1000 ohms per volt meter or better.